VIA FACSIMILE TRANSMISSION 571-273-8300

Docket No. 135271
PATENT

REMARKS

Claims 1-25 remain pending in the present application. It is respectfully submitted that the pending claims define allowable subject matter.

Initially, the Examiner is thanked for indicating claims 10-20 to be allowed and for indicating claims 24 and 25 to be allowable if rewritten in independent form. By the above claim amendments, claims 24 and 25 have been rewritten in independent form.

Turning to the prior art rejections, claims 1-9 and 21-23 have been rejected based on various combinations of prior art to O'Donnell, Chiang and Fraser. Applicants respectfully traverse these rejections for reasons set forth hereafter.

Claim 1 recite a sub-aperture transceiver system to be housed in an ultrasound probe that comprises, among other things, a signal processor located in the probe housing. The signal processor is coupled to receive and transmit sub-apertures of acoustic transceiver elements. The signal processor performs beamforming on the receive sub-aperture to produce a receive sub-aperture signal. The system further includes a receive sub-aperture output driven by the signal processor for carrying the receive sub-aperture signal from the probe housing.

It is respectfully submitted that the prior fails to teach or suggest any such structure. In O'Donnell, the catheter 5 includes an array 20, a multiplexer 32, summing circuit 35 and a transceiver/switch receiver circuitry 39. The multiplexer 32 is controlled by a single cable 34 that extends from the catheter 5 to remote imaging electronics. O'Donnell's catheter 5 does not include a signal processor. Further, O'Donnell's catheter 5 does not include any other circuitry that performs beamforming on a receive sub-aperture to produce a receive sub-aperture signal that is output from the probe housing.

Fraser and Chiang fail to make up for the deficiencies of O'Donnell. In Fraser, elevation beamforming is performed (as illustrated in Figures 11A-1C) through the use of analog delay line 106, or a CCD delay line 108, or a digital delay line 112. Fraser does not teach or suggest that it would be desirable or practical to provide a signal processor within

the probe housing and control the signal processor to perform beamforming on receive sub-apertures to produce a receive sub-aperture signal that is subsequently output from the probe housing.

Chiang describes a portable ultrasound imaging system that performs complete beamforming within the scanhead. Chiang describes various embodiments for providing beamforming and focusing circuits in the scanhead, however, in each of Chiang's embodiments, the beamforming and focusing circuits perform complete beamforming, not beamforming in connection with sub-apertures. Further, Chiang fails to teach or suggest that it would be desirable or practical to provide a signal processor in the probe housing, or to configure a signal processor to perform beamforming on receive sub-apertures to produce receive sub-apertures signals that are output from the probe housing. Thus, it is submitted that claim 1 is patentably distinct over the prior art.

Claim 21 is also patentable over the prior art. Claim 21 defines a method in an ultrasound system for sub-aperture processing. The method comprises performing sub-aperture beamforming, at a signal processor located in an ultrasound probe, based on a plurality of receive signals that are received from acoustic transducer elements that form a receive sub-aperture. Claim 21 further defines driving a receive sub-aperture output coupled to the signal processor with a receive sub-aperture signal. As explained above, the prior art fails to teach or suggest any such method steps. In O'Donnell, the catheter 5 is entirely void of any signal processor and does not perform beamforming at a receive sub-aperture level. In Fraser, the beamforming is not performed by signal processors at the sub-aperture level.